

CLAIMS

What is claimed is:

Sub a1
1. A percutaneously insertable intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, a tip, and a gas lumen insert, said catheter tube comprising a gas lumen disposed within an outer surface of the catheter tube, a proximal end of the balloon membrane is connected to a distal end of the catheter tube, a distal end of the balloon membrane is connected to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen.

2. A percutaneously insertable intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, a tip, and a gas lumen insert, said catheter tube comprising an inner lumen and a gas lumen disposed within an outer surface of the catheter tube, a proximal end of the balloon membrane is connected to a distal end of the catheter tube, a distal end of the balloon membrane is connected to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen.

3. A percutaneously insertable intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, a tip, and a gas lumen insert, said catheter tube comprising an inner tube portion, defining an inner lumen, and an outer tube portion, defining a gas lumen, a distal portion of said inner tube portion extending beyond a distal end of the outer tube portion and being connected to a distal end of the balloon membrane and to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen.

Sub a2
4. A percutaneously insertable intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, an inner tube, a tip, and a gas lumen insert, said catheter tube comprising

an inner tube portion and an outer tube portion defining a gas lumen, said inner tube being at least partially disposed within the inner tube portion and extending beyond a distal end of the outer tube portion and being connected to a distal end of the balloon membrane and to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen.

5) A percutaneously insertable intra-aortic balloon catheter comprising an outer tube, an inner tube, a balloon membrane, a tip, and a gas lumen insert, said inner tube being disposed within the outer tube, a distal portion of said inner tube extending beyond a distal end of the outer tube and being connected to a distal end of the balloon membrane and the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen.

6) The intra-aortic balloon catheter as claimed in claim 1 or 2 or 3 or 4 or 5 wherein the gas lumen insert is at least partially coated with a lubricant.

7) The intra-aortic balloon catheter as claimed in claim 1 or 2 or 3 or 4 or 5 further comprising a coil and a connector, said connector being connected to a proximal end of the catheter and having a gas lumen port and an inner lumen port, said gas lumen port communicating with said gas lumen and said inner lumen port communicating with said inner lumen, said gas lumen port being connected to a distal end of an extracorporeal tube, the gas lumen insert passing through said gas lumen port and said extracorporeal tubing, said coil being disposed in the extracorporeal tubing between an inner surface of the extracorporeal tubing and an outer surface of the gas lumen insert.

8) The intra-aortic balloon catheter as claimed in claim 1 or 2 or 3 or 4 or 5 further comprising a coil and a connector, said connector being connected to a proximal end of the catheter and having a gas lumen port and an inner lumen port, said gas lumen port communicating with said gas lumen and said

inner lumen port communicating with said inner lumen, said gas lumen port being connected to a distal end of an extracorporeal tube, the gas lumen insert passing through said gas lumen port and said extracorporeal tubing, said coil being disposed in the extracorporeal tubing between an inner surface of the extracorporeal tubing and an outer surface of the gas lumen insert, said gas lumen insert terminating in a one-way valve, said extracorporeal tubing terminating in a connector for connection to said one-way valve.

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9. The intra-aortic balloon catheter as claimed in claim 3 wherein the distal portion of the inner tube portion is made from a different material than the portion of the inner tube portion disposed within an outer surface of the catheter.

10. The intra-aortic balloon catheter as claimed in claim 3 wherein the distal portion of the inner tube portion is made from a different material than the portion of the inner tube portion disposed within an outer surface of the catheter, and wherein the distal portion of the inner tube portion and a distal end of the catheter are connected at a joint, the gas lumen insert extends beyond the distal end of the outer tube portion and overlaps the joint.

11. The intra-aortic balloon catheter as claimed in claim 5 wherein the distal portion of the inner tube is made from a different material than the portion of the inner tube disposed within an outer surface of the catheter.

12. The intra-aortic balloon catheter as claimed in claim 5 wherein the distal portion of the inner tube is made from a different material than the portion of the inner tube disposed within an outer surface of the catheter, and wherein the distal portion of the inner tube and a distal end of the catheter are connected at a joint, the gas lumen insert extends beyond the distal end of the outer tube and overlaps the joint.

13. A percutaneously insertable intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, an inner lumen

extension tube, a tip, a connector, a coil, an extracorporeal tube, and a gas lumen insert, said catheter tube comprising an inner tube portion, defining an inner lumen, and an outer tube portion, defining a gas lumen, a proximal end of said inner lumen extension tube being connected to a distal end of the inner tube portion at a joint, a distal end of said inner lumen extension tube being connected to a distal end of the balloon membrane and to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen, said gas lumen insert extending beyond the distal end of the outer tube portion and overlapping the joint, the connector being connected to a proximal end of the catheter and having a gas lumen port and an inner lumen port, said gas lumen port communicating with said gas lumen and said inner lumen port communicating with said inner lumen, said gas lumen port being connected to a distal end of the extracorporeal tube, the gas lumen insert passing through said gas lumen port and said extracorporeal tubing, said coil being disposed in the extracorporeal tubing between an inner surface of the extracorporeal tubing and an outer surface of the gas lumen insert, said gas lumen insert terminating on its proximal end in a one-way valve, said extracorporeal tubing terminating on its proximal end in a connector for connection to said one-way valve.

✓ 14. The intra-aortic balloon catheter as claimed in claim 13 wherein the catheter tube is at least partially made from polyurethane and the gas lumen insert is at least partially made from polyether block amide.

✓ 15. The intra-aortic balloon catheter as claimed in claim 2 or 3 or 4 wherein the catheter tube is at least partially made from polyurethane and the gas lumen insert is at least partially made from polyether block amide.

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16. The intra-aortic balloon catheter as claimed in claim 5 wherein the outer tube is at least partially made from polyurethane and the gas lumen insert is at least partially made from polyether block amide.

17. The intra-aortic balloon catheter as claimed in claim 1 or 2 or 3 or 4 or 5 wherein the gas lumen occupies more than one third of the cross sectional area of the gas lumen.

18. The intra-aortic balloon catheter as claimed in claim 1 or 2 or 3 or 4 or 5 where in the gas lumen occupies at least one half of the cross sectional area of the gas lumen.

19. A method for insertion of an intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, a tip, and a gas lumen insert, said catheter tube comprising a gas lumen disposed within an outer surface of the catheter tube, a proximal end of the balloon membrane is connected to a distal end of the catheter tube, a distal end of the balloon membrane is connected to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen, comprising the steps of:

a) Percutaneously inserting the catheter into a blood vessel of a patient;

b) Advancing the catheter into the blood vessel to a position appropriate for therapy; and

c) Removing the gas lumen insert from within the gas lumen by pulling the gas lumen proximal the catheter.

20. A method for insertion of an intra-aortic balloon catheter comprising a catheter tube, a balloon membrane, a tip, and a gas lumen insert, said catheter tube comprising an inner lumen and a gas lumen disposed within an outer surface of the catheter tube, a proximal end of the balloon membrane is connected to a distal end of the catheter tube, a distal end of the balloon membrane is connected to the tip, the gas lumen insert comprising a removable elongate body at least partially disposed within the gas lumen, comprising the steps of:

a) Percutaneously inserting the catheter into a blood vessel of a patient;

b) Advancing the catheter into the blood vessel to a position appropriate for therapy; and

c) Removing the gas lumen insert from within the gas lumen by pulling the gas lumen proximal the catheter.

21. The method as claimed in claim 19 or 20 wherein the gas lumen insert occupies more than one third of the cross sectional area of the gas lumen.

22. The method as claimed in claim 19 or 20 wherein the gas lumen insert occupies at least one half the cross sectional area of the gas lumen.

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